REMARKS

For convenience in discussing applicants' response to the Action, the headings in the Action are used below.

Double Patenting

The Office has maintained the provisional double patenting rejections of claims 2-8, 11, 13-15, 20-22 over claims of copending Application Nos. 10/363,039 and 10/673,348.

Applicants again request that these rejections be held in abeyance pending the determination of allowable subject matter in the present application or one of the related applications.

Specification

The disclosure is again objected to. The Office states that it is not clear how the different properties of binder α1 and binder β1 were obtained by the same process (i.e., Experiment 1) and that it is unclear how binder α2 is compositionally different from binder α3.

Applicants respectfully submit that the written description of their invention in the specification of the present application is clear and that a description of the compositions of the polyamic acids used to obtain binders α1 and binder β1 and of the compositions of binders α2 and α3 is not required for a person of ordinary skill in the art to understand the invention.

Applicants' invention is a negative electrode in which the current collector and binder of the active material layer are required to have certain mechanical properties. Claim 2 currently limits the binder to a polyimide. The examples in the specification demonstrate that if a polyimide binder possesses the requisite properties, the cycle characteristics of the negative electrode are unexpectedly improved. It is the properties of the polyimide binder and not its exact composition that are required for a person of ordinary skill in the art to obtain an understanding of the present invention.

The composition of the polyimide binders used in the examples of the present application is relevant only if a person of ordinary skill in the art could not practice the claimed invention without undue experimentation. However, as has been previously explained and is again discussed below, a person of ordinary skill in the art would understand, from a reading of the present specification and the knowledge attributed to the person of ordinary skill in the art, how to make and how to use the claimed invention without excessive experimentation.

It is also noted that none of the situations described in the MPEP concerning when a specification should be objected to, e.g., minor informalities or the like, suggest that the failure of

examples to describe the exact composition of the materials used therein, where the invention is not directed to the composition of the materials, is a basis for an objection to the specification.

Removal of the objection to the specification is believed to be in order and is respectfully requested.

Claim Rejections - 35 USC § 112

Claims 2-8, 13-15, 20-22 are again rejected under 35 U.S.C. 112, first paragraph, for lack of enablement. The Office's position is that it would require undue experimentation for a person of ordinary skill in the art to determine binders that have the properties recited in claim 2.

The issue raised under the enablement requirement of the first paragraph of 35 U.S.C. § 112, as explained in the Action, is whether the specification teaches a person skilled in the art to make and use the claimed invention without undue experimentation. The claimed invention in the present application, according to the claims as amended herein, is a negative electrode for a rechargeable lithium battery which includes a conductive metal foil current collector and an active material layer provided on a surface of the current collector and which comprises a polyimide binder and particles of active material containing silicon and/or a silicon alloy. The electrode is characterized in that the

current collector has mechanical properties of at least 80 N/mm^2 tensile strength, at least 30 N/mm^2 proportional limit, at least 1.0 % elongation at break and at least 0.03 % elastic elongation limit and the polyimide binder has mechanical properties of at least 50 N/mm^2 tensile strength, at least 10 % elongation at break, at least 2.5×10^{-3} J/mm^3 strain energy density and up to 10,000 N/mm^2 elastic modulus. Applicants have discovered that a binder having the properties recited in the claims can accommodate a high stress applied thereto as a result of volumetric expansion and shrinkage of the active material particles of the active material layer, and can prevents breakage of the binder during a charge-discharge reaction. The binder having the required properties is itself not novel.

The specific issue raised by the instant rejection under the first paragraph of 35 U.S.C. § 112 is whether a person of ordinary skill in the art could determine or obtain polyimides useful as the binder in the active material layer of the negative electrode of the present invention, i.e., polyimides having the properties recited in the claims, without undue experimentation.

The Office refers in the Action to various of the "Wands" factors in reaching its conclusion that the specification is not enabling for the full scope of the claims. The Office relies

heavily on a position that there is a high level of unpredictability in the art relating to the obtaining of polyimide binders with certain types of mechanical properties. The only support provided by the Office for this position is that "different mechanical properties are achieved by using different forms of polyamic acid." (Action, page 9, lines 5-6).

However, the fact that different forms of polyamic acid have different mechanical properties (or that different polyimides have different mechanical properties) does not mean that the determination of the different polyamic acids that provide these different mechanical properties or the determination of suitable polyimides that have the different properties is itself unpredictable. Different polyimides are expected to have different properties. The Office has not shown or explained why the different properties show unpredictability.

Applicants respectfully submit that polyimides and their properties are predictable. The amount of information in the art relating to polyimides and their properties is extensive. Polyimides, polyamic acids and techniques for preparing polyimides from polyamic acids and techniques for preparing polyimides according to other procedures are so well known and have been known for such a long time that there is very little unpredictability in

the art. Moreover, as has been previously noted, suitable polyimides for use in the invention are also commercially available.

As examples of evidence of the fact that polyimides are well-known in the art and that polyimides suitable for use in the present invention can be determined or obtained without undue experimentation, applicants noted in the response filed October 9, 2007, that the term "polyimides" appears in the title of 318 United States patents. The term "polyimide" appears in the title of 1336 United States patents. The terms "polyimide(s)", "binder", "lithium" and "battery" developed 25,100 "hits" in a Google search conducted October 9, 2007. The terms "polyimide", "binders", "lithium" and "battery" developed 31,700 "hits". The terms "polyimide", "binders", "lithium" and "batteries" developed 37,800 "hits".

Applicants also submitted a document and English translation of pertinent portions thereof with the response filed October 9, 2007, identifying characteristics of commercially available binders. The mechanical properties of the polyimide binder recited in claim 2 of the present application correspond to the following items listed in Table 4.1-2:

- Tensile Strength: Tensile Strength (25°C);

- Elongation at Break: Coefficient of Extension (25°C)

and

- Elastic Modulus: Coefficient of Elasticity (25°C).

The relationship between the units kg/mm^2 and N/mm^2 is 9.80665 $kg/mm^2 = N/mm^2$.

Referring to Table 4.1-2 (and converting to the relevant units), it is seen that the mechanical properties of "Upilex R" and "Upilex S" of Ube Machinery are as follows:

	Upilex R	Upilex S
Tensile Strength (N/mm^2)	245	392
Elongation at Break (%)	130	30
Elastic Modulus (N/mm^2)	3724	8820

These properties correspond closely to those of binders α1 and β1 in the experiments in the present application and are within the scope of the properties required of the polyimide binder. This information is evidence of the commercial availability of suitable polyimide binders.

The attention of the Office is also directed to any encyclopedia of chemical technology for a discussion of polyimides and their properties.

For the above reasons applicants submit that polyimides are well known, that there is a high level of predictability in the art

relating to polyimides and that, therefore, little guidance in the specification is required for a person of ordinary skill in the art to determine polyimide binders suitable for use in the present invention without undue experimentation.

The present application complies with the how to make and how to use requirements of 35 U.S.C. § 112, first paragraph. Removal of the 35 U.S.C. 112, first paragraph, rejection of the claims is believed to be in order and is respectfully requested.

Claim Rejections - 35 USC § 103

Claims 2-8, 13-15, 20-22 are rejected under 35 U.S.C. 103(a) as obvious over Nobufumi (JP 2000-012088) in view of Solomon (U.S. Patent No. 4,927,514) and Fujimoto (U.S. Patent No. 5,468,571), as evidenced by the glass transition point and melting point of polytetrafluoroethylene, retrieved by the Office on March 23, 2007, from the Internet (refer to page 13 of the Action for the link).

The position of the Office is that it would have been obvious to use the polyimide binder of Fujimoto in place of the PTFE binder in the negative electrode of Nobufumi and to sinter the electrode at a temperature that does not cause deleterious polymer decomposition.

In the response filed October 9, 2007, applicants argued that a person of ordinary skill in the art would not be motivated to

apply the teachings of Solomon relating to a platinum black air cathode to the negative electrode of the lithium secondary battery of Nobufumi. The properties desired of the platinum black air cathode for an electrolytic cell for producing ozone of Solomon in which an active layer comprising platinum black and PTFE are deposited on a support layer comprising a mixture of particulate carbon with hydrophobic polymer are not the same properties required for the negative electrode for a nonaqueous secondary battery of Nobufumi in which an active layer comprising a silicon-containing material, carbon and a binder are deposited on an electrolytic copper foil. Applicants respectfully submit that this argument is pertinent to the 35 U.S.C. § 103(a) rejection in the present Action and that the Office has not provided proper rational supporting its position.

Moreover, in the present action, the Office takes the position that the mechanical properties for the current collector recited in claim 2 would have been met by a process in which a surface roughened copper foil current collector and the binder are sintered below the decomposition temperature and above the melting temperature of the binder (page 16, lines 3 to 6 of the Action). However, the data in the present application rebut this position. Specifically, a comparison between batteries A16 and B5 in Table 15

of the specification of the present application and battery B5 with the current collector b2, which has mechanical properties outside of the scope of the present invention, shows poor cycle characteristics. Both of the current collectors a8 and b2 were subjected to a heat treatment at 170°C for 20 hours, which corresponds to a heat treatment below the decomposition temperature and above the glass transition temperature of the binder, as shown in Tables 13 and 14. Therefore, the mechanical properties for the current collector recited in claim 2 are not inherently met by a process in which a surface roughened copper foil current collector are sintered below the decomposition temperature and above the glass transition temperature of the binder.

For this reason also the 35 U.S.C. § 103(a) rejection is improper and should be removed.

Finally, even if it is assumed for the sake of argument that the Office has supported a case of prima facie obviousness, the comparative data in the application demonstrate the criticalness of the mechanical properties of the current collector and of the mechanical properties of the binder of the active material layer of the negative electrode of the present invention in obtaining unexpected superior charge-discharge cycle characteristics. The showing in the examples of the criticalness of the mechanical

properties of the current collector and of the mechanical properties of the binder of the active material layer of the negative electrode of the present invention demonstrates the non-obviousness of the negative electrode of the present invention and rebuts any prima facie obviousness supported by the cited prior art.

Removal of the 35 U.S.C. § 103(a) ground of rejection is also in order.

The foregoing is believed to be a complete and proper response to the Office Action dated December 28, 2007.

In the event that this paper is not considered to be timely filed, applicants hereby petition for an appropriate extension of time. The fee for any such extension and any additional required fees may be charged to Deposit Account No. 111833.

Respectfully submitted,

KUBOVCIK & KUBOVCIK

Ronald J. Kubovcik
Reg. No. 25,401

Atty. Case No. MAM-056
Crystal Gateway 3
Suite 1105
1215 South Clark Street
Arlington, VA 22202
Tel: (703) 412-9494
Fax: (703) 412-9345
RJK/JBF